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IS IT POSSIBLE TO MEASURE THE GRAVITOMAGNETIC FIELD WITH CLOCKS?

Abstract

On the level of orbits of satellites the gravitomagnetic field of a rotating gravitating body like the Earth manifests itself in the precession of the orbital plane wich is known as the Lense-Thirring effect. Here we discuss the question whether this gravitomagnetic field can also be detected by using clocks aboard orbiting satellites. With 10^{-7} sec the effect on clocks is relatively large for a clock orbiting the Earth. However, the detectability of this effect depends on the accuracy and stability of the used clocks as well as on the precise knowledge of the satellite's orbits. We show that with present technology it is possible in principle to measure this gravitomagnetic clock effect. In particular, we analyze whether this gravitomagnetic clock effect has any impact on the clocks on board of the Galileo satellites and, thus, on Galileo positioning. Such a measurement would constitute another important Solar System test of Einstein's General Relativity.